

06/30/98
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PTO/SB/05 (12/97)

Approved for use through 09/30/00. OMB 0651-0032

Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

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06/30/98

UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No. 082771.P277 Total Pages 2

First Named Inventor or Application Identifier Shantigram Jagannath, et al.

Express Mail Label No. EL034145171US

ADDRESS TO: Assistant Commissioner for Patents
Box Patent Application
Washington, D. C. 20231

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. X Fee Transmittal Form
(Submit an original, and a duplicate for fee processing)
2. X Specification (Total Pages 15)
(preferred arrangement set forth below)
 - Descriptive Title of the Invention
 - Cross References to Related Applications
 - Statement Regarding Fed sponsored R & D
 - Reference to Microfiche Appendix
 - Background of the Invention
 - Brief Summary of the Invention
 - Brief Description of the Drawings (if filed)
 - Detailed Description
 - Claims
 - Abstract of the Disclosure
3. X Drawings(s) (35 USC 113) (Total Sheets 7)
4. X Oath or Declaration (Total Pages 4) (unsigned)
 - a. Newly Executed (Original or Copy)
 - b. Copy from a Prior Application (37 CFR 1.63(d))
(for Continuation/Divisional with Box 17 completed) (**Note Box 5 below**)
 - i. DELETIONS OF INVENTOR(S) Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
5. Incorporation By Reference (useable if Box 4b is checked)
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
6. Microfiche Computer Program (Appendix)

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7. ☐ Nucleotide and/or Amino Acid Sequence Submission
(if applicable, all necessary)
a. ☐ Computer Readable Copy
b. ☐ Paper Copy (identical to computer copy)
c. ☐ Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

8. ☐ Assignment Papers (cover sheet & documents(s))
9. ☐ a. 37 CFR 3.73(b) Statement (where there is an assignee)
☐ b. Power of Attorney
10. ☐ English Translation Document (if applicable)
11. ☐ a. Information Disclosure Statement (IDS)/PTO-1449
☐ b. Copies of IDS Citations
12. ☐ Preliminary Amendment
13. ☐ Return Receipt Postcard (MPEP 503) (Should be specifically itemized)
14. ☐ a. Small Entity Statement(s)
☐ b. Statement filed in prior application, Status still proper and desired
15. ☐ Certified Copy of Priority Document(s) (if foreign priority is claimed)
16. ☐ Other: _____

17. **If a CONTINUING APPLICATION**, check appropriate box and supply the requisite information:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP)
of prior application No: _____

18. Correspondence Address

____ Customer Number or Bar Code Label _____
(Insert Customer No. or Attach Bar Code Label here)
or

☒ Correspondence Address Below

NAME David R. Halvorson
BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP

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Seventh Floor

CITY Los Angeles STATE California ZIP CODE 90025-1026

Country U.S.A. TELEPHONE (408) 720-8598 FAX (408) 720-9397

12/01/97

- 2 -

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FEE TRANSMITTAL

TOTAL AMOUNT OF PAYMENT (\$) 960.00

Complete if Known:

Application No. _____

Filing Date _____

First Named Inventor Shantigram Jagannath, et al.

Group Art Unit _____

Examiner Name _____

Attorney Docket No. 082771.P277

Express Mail No.: EL034145171US

METHOD OF PAYMENT (check one)

1. ☒ The Commissioner is hereby authorized to charge indicated fees and credit any over payments to:

Deposit Account Number 02-2666

Deposit Account Name _____

☐ Charge Any Additional Fee Required Under 37 CFR 1.16 and 1.17

☐ Charge the Issue Fee Set in 37 CFR 1.18 at the Mailing of the Notice of Allowance, 37 CFR 1.131(b)

2. ☒ Payment Enclosed

☒ Check

☐ Money Order

☐ Other

FEE CALCULATION (fees effective 10/01/97)

1. FILING FEE

Large Entity		Small Entity		Fee Description	Fee Paid
Fee Code	Fee (\$)	Fee Code	Fee (\$)		
101	790	201	395	Utility application filing fee	<u>790.00</u>
106	330	206	165	Design application filing fee	_____
107	540	207	270	Plant filing fee	_____
108	790	208	395	Reissue filing fee	_____
114	150	214	75	Provisional application filing fee	_____
SUBTOTAL (1)					\$ <u>790.00</u>

2. CLAIMS

			Extra		Fee from below		Fee Paid
Total Claims	<u>24</u>	- 20 =	<u>4</u>	X	<u>22.00</u>	=	<u>88.00</u>
Independent Claims	<u>4</u>	- 3 =	<u>1</u>	X	<u>82.00</u>	=	<u>82.00</u>
Multiple Dependent Claims				X		=	

Large Entity		Small Entity		Fee Description	Fee Paid
Fee Code	Fee (\$)	Fee Code	Fee (\$)		
103	22	203	11	Claims in excess of twenty	<u>88.00</u>
102	82	202	41	Independent claims in excess of 3	<u>82.00</u>
104	270	204	135	Multiple dependent claim	_____
109	82	209	41	Reissue independent claims over original patent	_____
110	22	210	11	Reissue claims in excess of 20 and over original patent	_____
SUBTOTAL (2)					\$ <u>170.00</u>

12/01/97

FEE CALCULATION (continued)

3. ADDITIONAL FEES

<u>Large Entity</u>		<u>Small Entity</u>		<u>Fee Description</u>	<u>Fee Paid</u>
<u>Fee</u>	<u>Fee</u>	<u>Fee</u>	<u>Fee</u>		
<u>Code</u>	<u>(\$)</u>	<u>Code</u>	<u>(\$)</u>		
105	130	205	65	Surcharge - late filing fee or oath	_____
127	50	227	25	Surcharge -late provisional filing fee or cover sheet	_____
139	130	139	130	Non-English specification	_____
147	2,520	147	2,520	For filing a request for reexamination	_____
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	_____
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action	_____
115	110	215	55	Extension for response within first month	_____
116	400	216	200	Extension for response within second month	_____
117	950	217	475	Extension for response within third month	_____
118	1,510	218	755	Extension for response within fourth month	_____
128	2,060	228	1,030	Extension for response within fifth month	_____
119	310	219	155	Notice of Appeal	_____
120	310	220	155	Filing a brief in support of an appeal	_____
121	270	221	135	Request for oral hearing	_____
138	1,510	138	1,510	Petition to institute a public use proceeding	_____
140	110	240	55	Petition to revive unavoidably abandoned application	_____
141	1,320	241	660	Petition to revive unintentionally abandoned application	_____
142	1,320	242	660	Utility issue fee (or reissue)	_____
143	450	243	225	Design issue fee	_____
144	670	244	335	Plant issue fee	_____
122	130	122	130	Petitions to the Commissioner	_____
123	50	123	50	Petitions related to provisional applications	_____
126	240	126	240	Submission of Information Disclosure Stmt	_____
581	40	581	40	Recording each patent assignment per property (times number of properties)	_____
146	790	246	395	For filing a submission after final rejection (see 37 CFR 1.129(a))	_____
149	790	249	395	For each additional invention to be examined (see 37 CFR 1.129(a))	_____
Other fee (specify) _____					_____
Other fee (specify) _____					_____

SUBTOTAL (3) \$ 0

*Reduced by Basic Filing Fee Paid

SUBMITTED BY:

Typed or Printed Name: David R. Halvorson

Signature [Signature] Date 6/30/98

Reg. Number 33,395 Deposit Account User ID _____ (complete if applicable)

82771.P277

UNITED STATES PATENT APPLICATION

FOR

METHOD AND APPARATUS FOR VIRTUAL OVERLAY NETWORKS

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82771.P277

1
2 BACKGROUND OF THE INVENTION

3
4 1. FIELD OF THE INVENTION

5 The present invention relates to the field of networking and more
6 specifically to virtual overlay networks (VONs) and virtual private networks
7 (VPNs).
8

9 2. DESCRIPTION OF THE RELATED ART

10 Virtual private networks (VPNs) allow users to appear to be on the
11 same private network although there may be many (usually public) networks
12 in between the users. Figure 1A illustrates the logical appearance to users of
13 a virtual private network . Figure 1B illustrates a high level view of the actual
14 network configuration.

15 Packets destined from one user (say in Chicago in the illustration of
16 Figure 1B) to another user (say in Boston in the illustration of Figure 1B) may
17 be transmitted through an internet service provider (ISP) which supports
18 VPNs. Each site connected to the ISP network advertises to the ISP a set of
19 destinations reachable within the site. The ISP then redistributes this
20 information to all other sites in the set of sites which form the VPN. This
21 process is further described in Heinanen, et al., VPN support with MPLS,
22 Internet Draft, draft-heinanen-mpls-vpn-01.txt, March 1998.

23 Since the ISP may support multiple VPNs, and since these VPNs may use
24 private address spaces (and, thus the addresses spaces may be non-
25 unique), the routing system within the ISP needs to be able to unambiguously
26 differentiate reachability information (i.e., private address space information)

1 for the various VPNs. Heinanen, et al describes that this may be
2 accomplished by having the ISP assign each VPN its own VPN identifier
3 (VPN-ID) and having the routing system use a combination of the VPN-ID
4 and the reachability information provided by the sites for routing. In such a
5 system, a single routing system may support multiple VPNs whose address
6 spaces overlap with each other.

7 Figure 2 illustrates an exemplary prior art routing system using VPN-IDs
8 and reachability information provided by the sites for routing. As illustrated
9 by Figure 2, a packet to be routed may include a virtual private network
10 identifier (VPN-ID) 201, reachability information (e.g., private addressing
11 information) 202, an internet protocol (IP) header 203 and payload
12 information 204. A single route table 206 is maintained and is indexed by the
13 combination of the VPN-ID 201 and the reachability information 202.

14 As is shown in Figure 2, prior art solutions provide a flat address
15 routing space by simply combining the VPN-ID with the reachability
16 information provided by the sites.

17 It would be useful to provide more fine-grained control over the routed
18 topology for individual VPNs.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1A illustrates a logical representation of a virtual private network.

Figure 1B illustrates a high level conceptual representation of virtual private network.

Figure 2 illustrates a prior art packet / routing table arrangement.

Figure 3A illustrates a first embodiment of a packet / routing table arrangement as may be implemented by the present invention.

Figure 3B illustrates a second embodiment of a packet / routing table arrangement as may be implemented by the present invention.

Figure 3C illustrates a third embodiment of a packet / routing table arrangement as may be implemented by the present invention.

Figure 4 is a high level diagram illustrating a network as may implement the present invention.

For ease of reference, it might be pointed out that reference numerals in all of the accompanying drawings typically are in the form "drawing number" followed by two digits, xx; for example, reference numerals on Figure 1 may be numbered 1xx; on Figure 3, reference numerals may be numbered 3xx. In certain cases, a reference numeral may be introduced on one drawing and the same reference numeral may be utilized on other drawings to refer to the same item.

1 DETAILED DESCRIPTION OF
2 THE EMBODIMENTS THE PRESENT INVENTION
3

4 As was discussed above, Virtual private networks (VPNs) allow users
5 to appear to be on the same private network although there may be many
6 (usually public) networks in between the users.

7 Packets destined from one to another user may be transmitted through an
8 internet service provider (ISP) which supports VPNs. Each site connected to
9 the ISP network advertises to the ISP a set of destinations reachable within
10 the site. The ISP then redistributes this information to all other sites in the set
11 of sites which form the VPN. Since the ISP may support multiple VPNs, and
12 since these VPNs may use private address spaces (and, thus the addresses
13 spaces may be non-unique), the routing system within the ISP needs to be
14 able to unambiguously differentiate reachability information (i.e., private
15 address space information) for the various VPNs.

16 A similar issue regarding need to unambiguously differentiate reachability
17 information exists with Virtual Overlay Networks (VONs). VONs provide the
18 capability to build logical independent networks over a shared public network
19 infrastructure. VONs are particularly attractive to bandwidth and network
20 infrastructure wholesalers and can also benefit both ISPs and private
21 enterprise networks. VONs allow logical partitioning of networks without
22 building expensive filtering mechanisms. For example, multiple small ISPs
23 could share the same network infrastructure (consisting of, e.g., high
24 bandwidth links and high end router devices) while each ISP could be
25 provisioned to offer specific and tailored services (e.g., real time multicast
26 service) to targeted customers. The concept could also be applied in the

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1 This approach of providing a logically separated routed topology for each
2 VPN offers significant advantages over prior art approaches. Utilizing this
3 approach, an ISP may, for example:

- 4 1. choose which links and nodes are in a given VPN;
- 5 2. assign a given link different administrative weights for different
6 VPNs; and
- 7 3. allocate different service levels/guarantees for different VPNs or
8 provisions the service levels and guarantees differently.
- 9 4. use different routing protocols for the different VPNs
- 10 5. completely isolate the traffic of one VPN from another.

11 Multi Protocol Label Switching (MPLS) is used on the data plane in
12 certain embodiments of the present invention. MPLS is described in greater
13 detail in Callon et al.,. MPLS is intended to simplify the forwarding function of
14 routing devices by introducing a connection-oriented mechanism inside the
15 otherwise connectionless IP technology. A label switched path (LSP) is set
16 up for each route. Edge routers analyze the traditional IP header (such as IP
17 header 203) to decide which LSP to use and add a corresponding label
18 switched path identifier in the form of a label (such as is show in Figure 3A as
19 VPN-ID 201, in Figure 3B as VPN-ID 201 and forwarding label 302 and in
20 Figure 3C as VPN-ID/forwarding label 311.

21 As will be described, MPLS may be used to facilitate implementation of
22 logically separated VPNs.

23 Figure 4 provides a high level overview of a network as may implement
24 the present invention. An edge router (such as router 401, 402 or 403) which
25 resides at the enterprise or alternatively, at the ISP's site. The edge router
26 401-3 classifies packets onto a given VPN. The packet-to-VPN classification

1 may be based on standard filtering techniques (e.g., input port and IP header
2 mask). The edge router 401-403 then applies a VPN-specific label to the
3 packet so that it can be routed by the backbone routers 411-413 in the wide
4 area network cloud.

5 Three alternative approaches for providing logically separated routed
6 topologies are described in connection with Figures 3A-C.

7 Turning first to Figure 3A, the label (e.g., VPN-ID 201) is used to
8 identify a routing table 304 or 305. The packet is then routed based on the
9 reachability information in the IP header 203. In this embodiment, no label
10 distribution protocol (e.g. MPLS) is required.

11 Figure 3B illustrates an approach utilizing a label stack comprising the
12 VPN-ID 201 and a forwarding label 302. In this embodiment, the VPN-ID
13 201 indicates an MPLS forwarding table 308, 309 which corresponds to the
14 VPN-ID. The forwarding label 302 provides MPLS label switching
15 information. By utilizing this embodiment, multiple instances of the standard
16 MPLS distribution protocol can be utilized.

17 Finally, turning to Figure 3C, each router is allowed to manage its own
18 MPLS flat label space. Each router is responsible for keeping track of which
19 VPN each label refers to and for routing them accordingly. The router locally
20 builds the labels based on its route tables and VPN-ID information and stores
21 them in a single MPLS forwarding table 312. In this embodiment, the router
22 still maintains separate route tables for each VPN. In the described
23 embodiment, as illustrated by Figure 3C, this is accomplished by extending
24 the label distribution protocol to carry a VPN-ID with the forwarding label as a
25 combined VPN-ID/forwarding label 311.

1

2 Thus, what has been disclosed a method and apparatus for

3 maintaining logically separate routing topologies based on virtual private

4 networks.

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CLAIMS

What is claimed is:

1. A router comprising:
 - a) a first port for receiving a packet having a label, a header and a payload;
 - b) a table associated with the label; and
 - c) a processor for processing the packet in accordance with the table.
2. The router as recited by claim 1 wherein in the table is a route table.
3. The router as recited by claim 1 wherein the table is a forwarding table.
4. The router as recited by claim 1 wherein the label identifies a virtual private network.
5. The router as recited by claim 1 further having a second port for transmitting said packet.
6. The router as recited by claim 1 wherein the header is an internet protocol header.
7. The router as recited by claim 1 wherein the label comprising information identifying a virtual private network and a forwarding label.

8. A method of routing in a network comprising:
 - a) maintaining a first table corresponding to a first virtual private network;
 - b) maintaining a second table corresponding to a second virtual private network;
 - c) routing a packet based on the first table or the second table
9. The method as recited by claim 8 wherein the first table and the second table are route tables.
10. The method as recited by claim 8 wherein the first table and the second table are forwarding tables
11. The method as recited by claim 9 further comprising the step of maintaining forwarding table indexable by a virtual private network identifier.
12. The method as recited by claim 8 wherein the packet comprises a label, a header and a payload.
13. The method as recited by claim 8 wherein the label comprises information identifying a virtual private network.
14. The method as recited by claim 8 wherein the label comprises information identifying a virtual private network and a forwarding label.

15. The method as recited by claim 9 wherein the first table or the second route table is chosen for routing the packet based on the label.
16. A method of routing in a network comprising:
 - a) maintaining a first forwarding table corresponding to a first virtual private network;
 - b) maintaining a second forwarding table corresponding to a second virtual private network;
 - c) routing a packet based on the first forwarding table or the forwarding table
17. The method as recited by claim 16 wherein the packet comprises a label, a header and a payload.
18. The method as recited by claim 16 wherein the label comprises information identifying a virtual private network.
19. The method as recited by claim 16 wherein the label comprises information identifying a virtual private network and a forwarding label.
20. The method as recited by claim 16 wherein the first table or the second table is chosen for routing the packet based on the label.
21. A network comprising:
 - a) a first edge router coupled to receive a packet having a first header and a second header and to transmit into a wide area

network cloud a modified packet having a label, the first header and the second header;

- b) a backbone router coupled to receive the modified packet and route the modified packet based on a route table associated with the label; and
- c) a second edge router coupled to receive the modified packet.

- 22. The network as recited by claim 21 wherein the label comprises information identifying a virtual private network.
- 23. The network as recited by claim 21 wherein the label comprises information identifying a virtual private network and a forwarding label.
- 24. The network as recited by claim 21 wherein the backbone router comprises a second route table.

ABSTRACT OF THE DISCLOSURE

A method and apparatus for directing messages through a network wherein multiple tables for directing messages through the network are maintained and provided. Each table corresponds to a virtual private network and contains routing information specific to that virtual private network. A separate routing table is maintained for each VPN. In one embodiment the messages are forwarded using plain IP forwarding using a route table associated with the VPN. In another embodiment separate forwarding tables using labels are generated for each virtual private network. The messages are forwarded by looking up the label in the table corresponding to the VPN. In a third embodiment, a single forwarding table is utilized where the table is built based on separate routing tables for each virtual private network.

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Virtual Private Network as it appears to users.

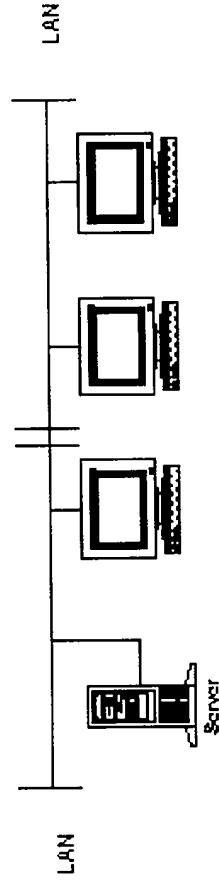


FIGURE 1A

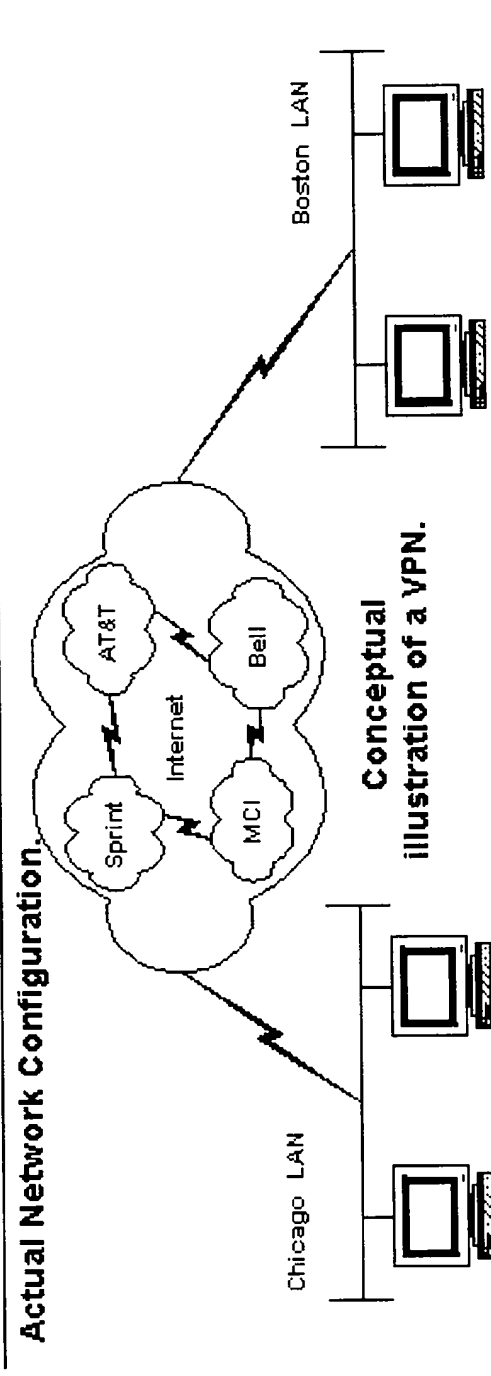


FIGURE 1B

ROUTE TABLE 206

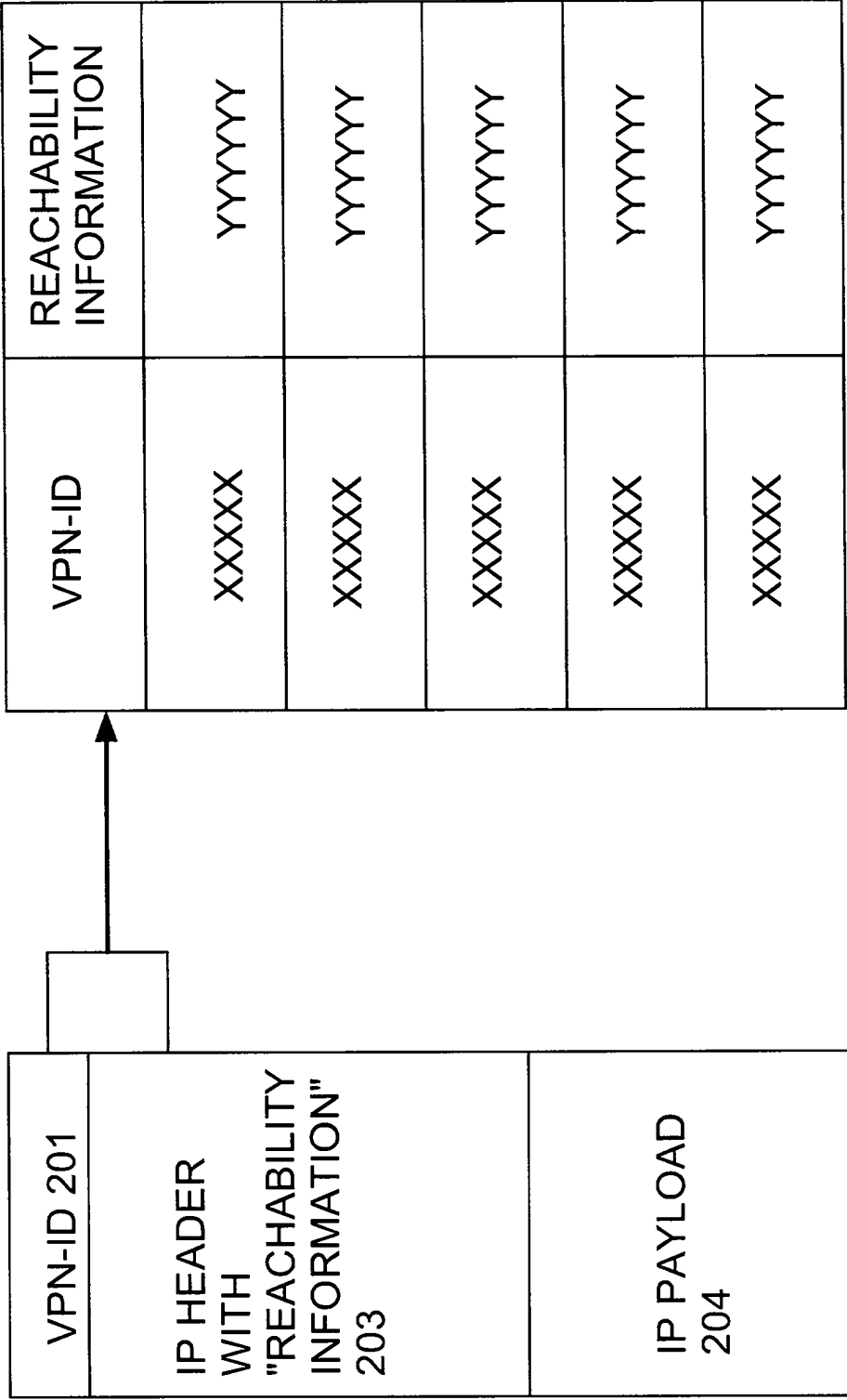


FIGURE 2

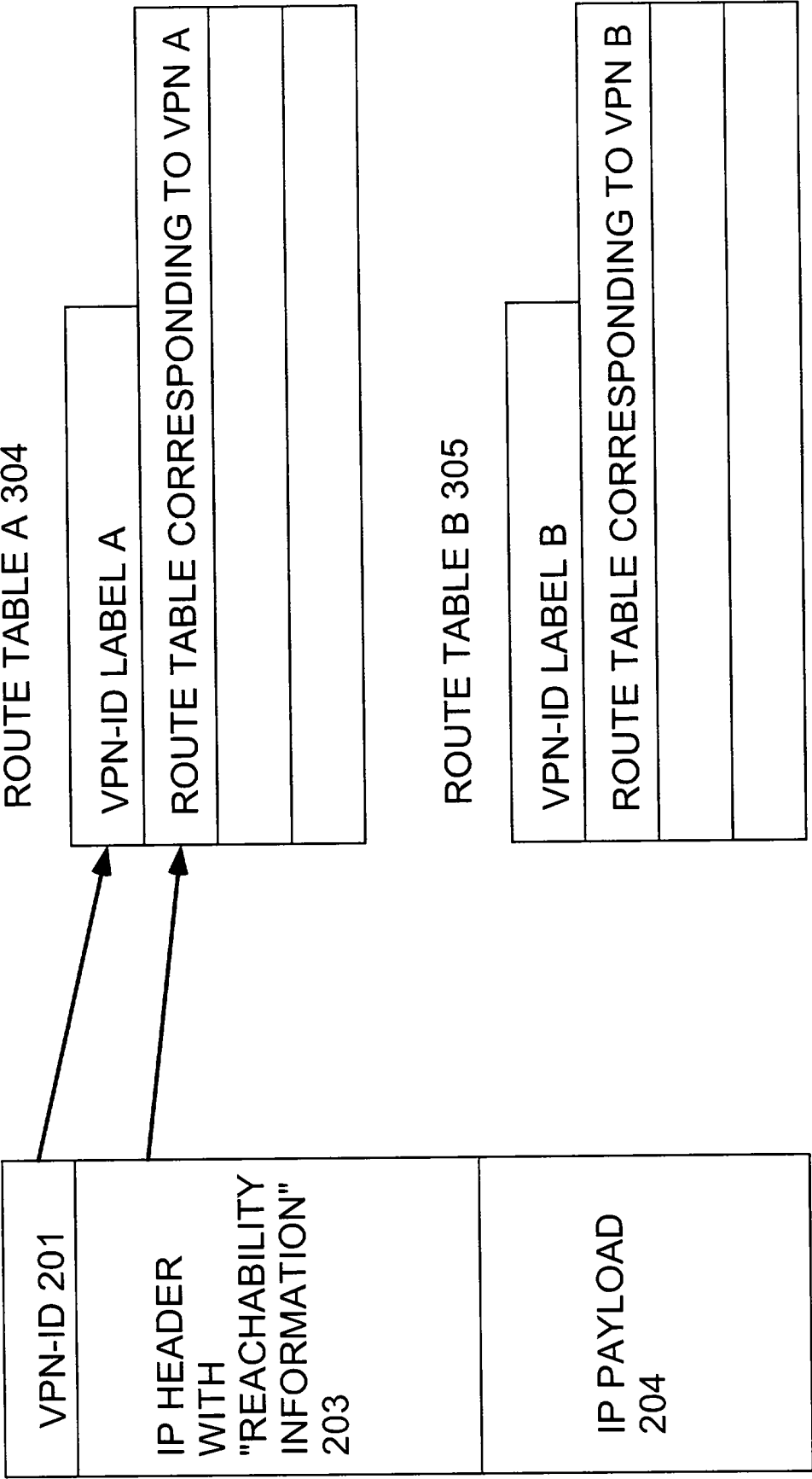


FIGURE 3A

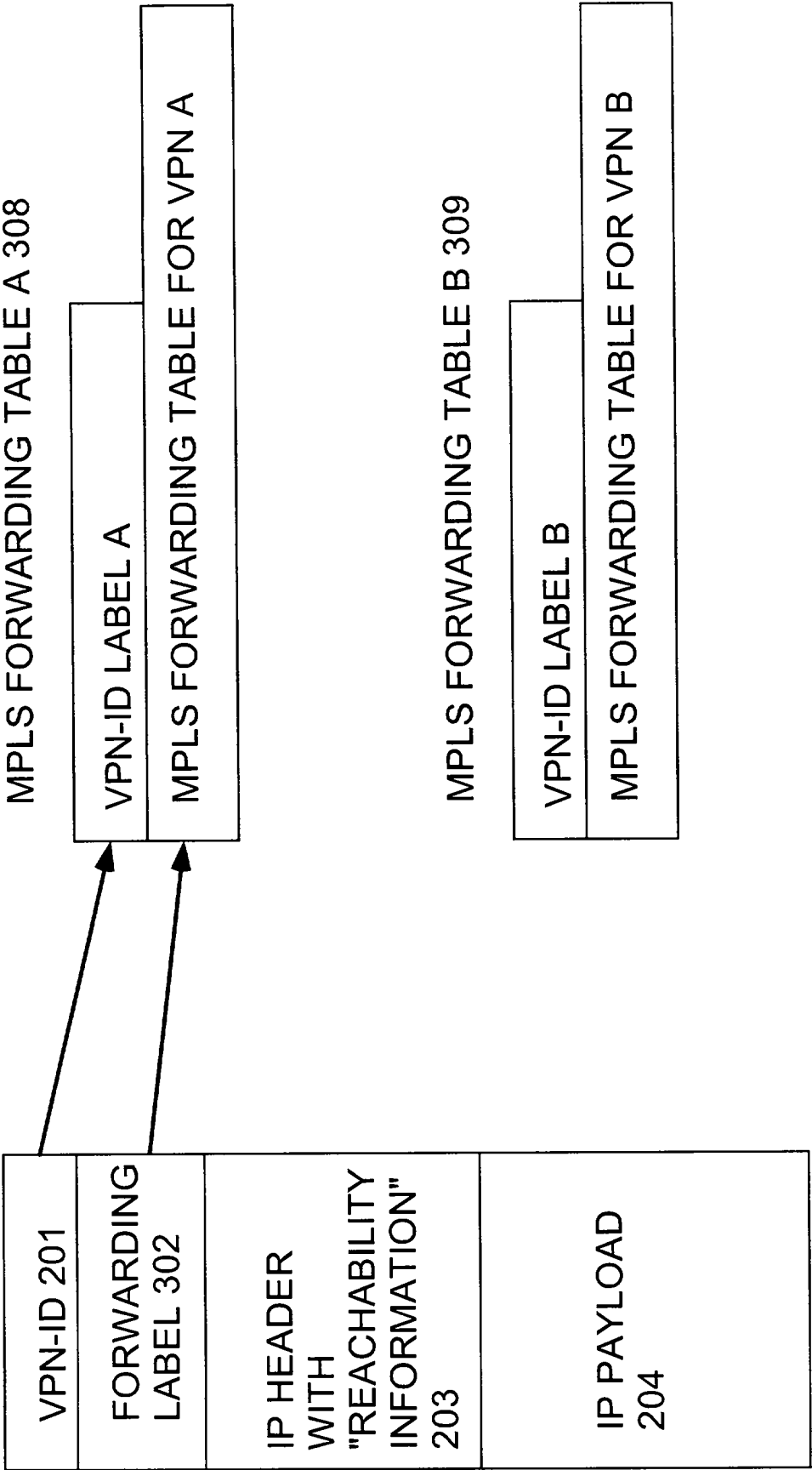


FIGURE 3B

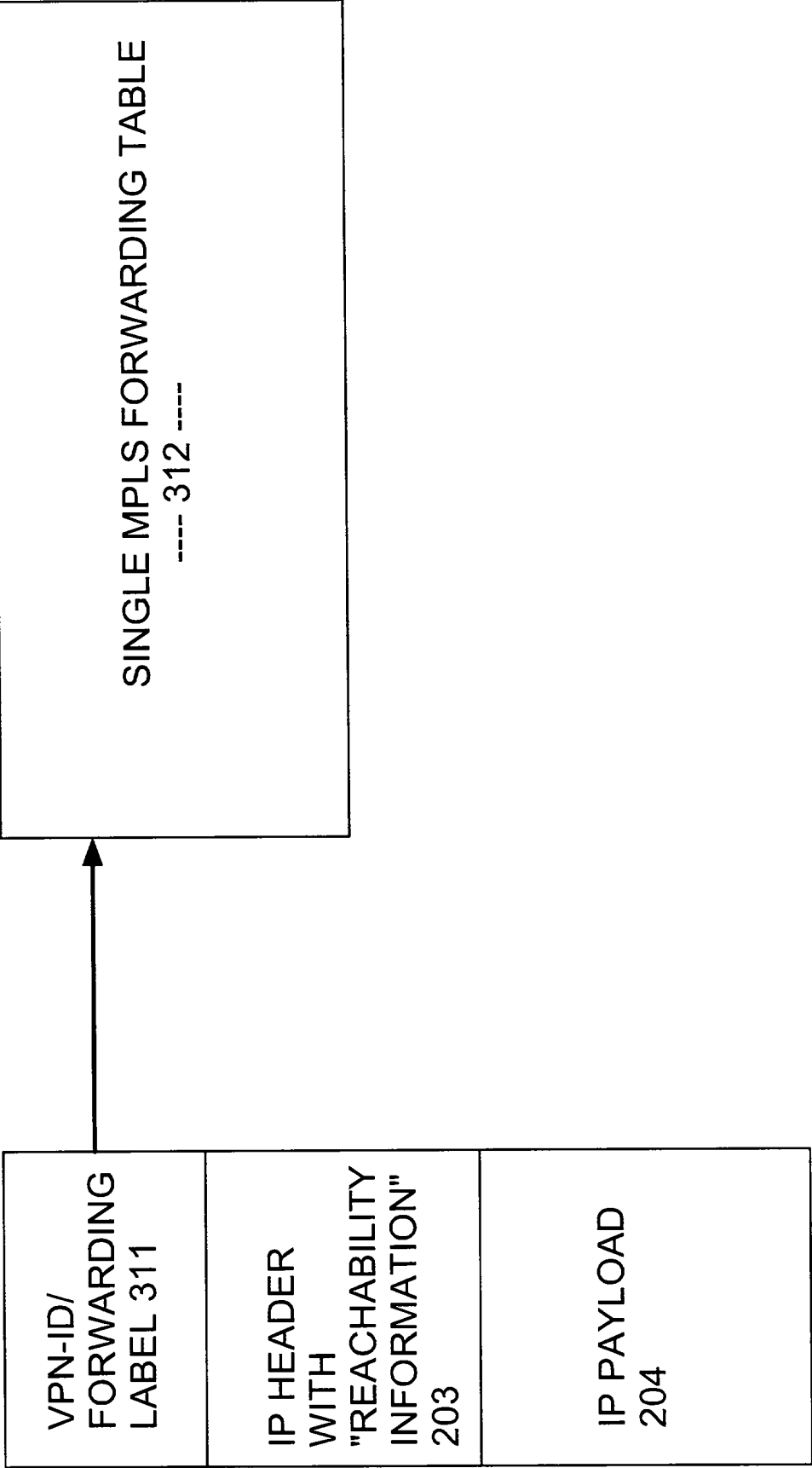


FIGURE 3C

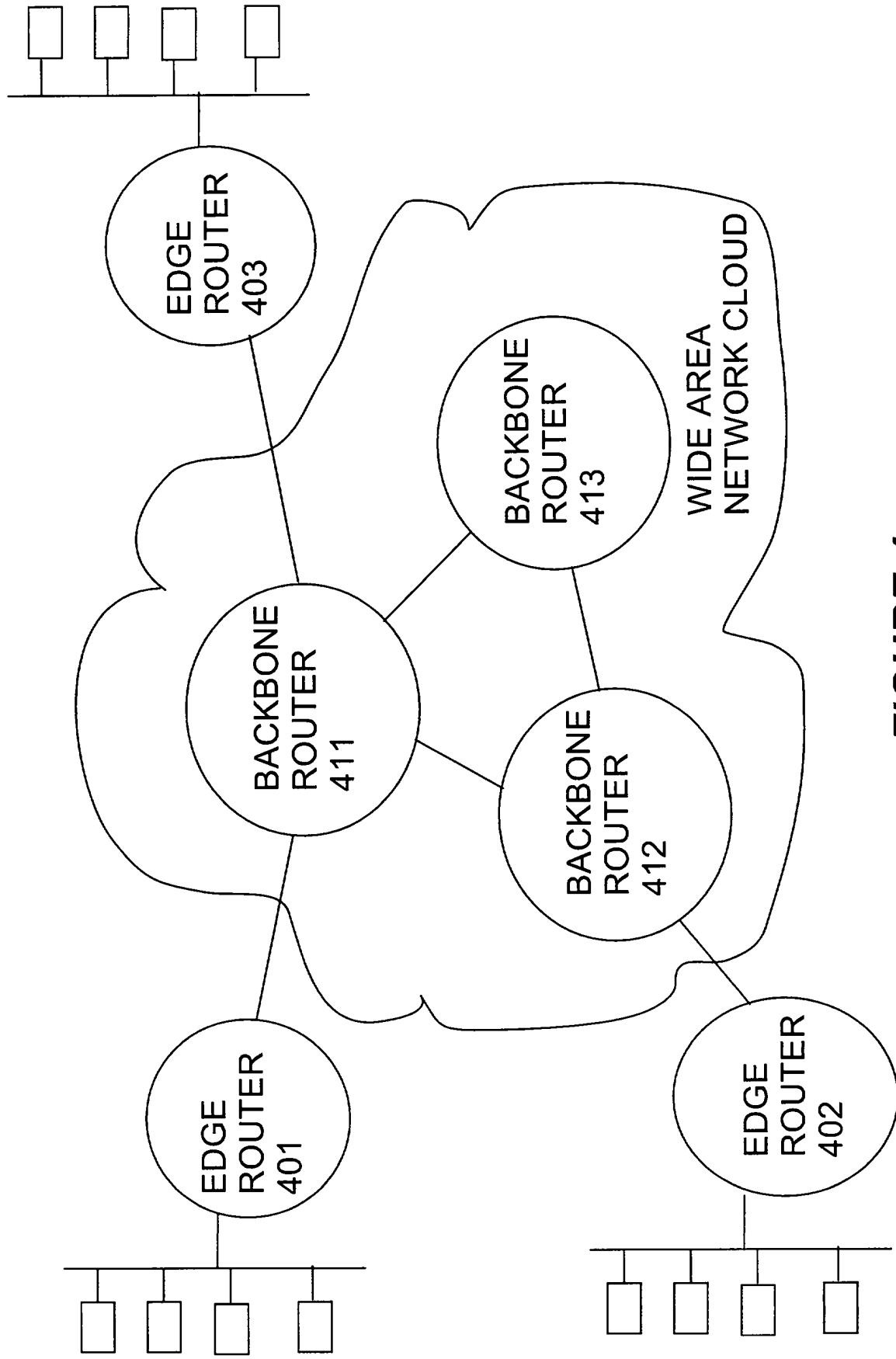


FIGURE 4

As a below named inventor, I hereby declare that:

I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Method and Apparatus for Virtual Overlay Networks

the specification of which

x is attached hereto.
_____ was filed on _____ as
United States Application Number _____
or PCT International Application Number _____
and was amended on _____

(if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment referred to above.

I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d), of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

<u>Prior Foreign Application(s)</u>			<u>Priority Claimed</u>	
<u>(Number)</u>	<u>(Country)</u>	<u>(Day/Month/Year Filed)</u>	<u>Yes</u>	<u>No</u>
<u>(Number)</u>	<u>(Country)</u>	<u>(Day/Month/Year Filed)</u>	<u>Yes</u>	<u>No</u>
<u>(Number)</u>	<u>(Country)</u>	<u>(Day/Month/Year Filed)</u>	<u>Yes</u>	<u>No</u>
<u>(Number)</u>	<u>(Country)</u>	<u>(Day/Month/Year Filed)</u>	<u>Yes</u>	<u>No</u>

I hereby claim the benefit under title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below

(Application Number)	Filing Date
(Application Number)	Filing Date

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Number)	Filing Date	(Status -- patented, pending, abandoned)
(Application Number)	Filing Date	(Status -- patented, pending, abandoned)

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I hereby declare that all statements made herein of my own knowledge are true and that all
statements made on information and belief are believed to be true; and further that these
statements were made with the knowledge that willful false statements and the like so made are
punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States
Code and that such willful false statements may jeopardize the validity of the application or any
patent issued thereon.

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Title 37, Code of Federal Regulations, Section 1.56
Duty to Disclose Information Material to Patentability

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is cancelled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is cancelled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

(1) Prior art cited in search reports of a foreign patent office in a counterpart application, and

(2) The closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.

(b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and

(1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim; or

(2) It refutes, or is inconsistent with, a position the applicant takes in:

(i) Opposing an argument of unpatentability relied on by the Office, or

(ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

(c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:

(1) Each inventor named in the application;

(2) Each attorney or agent who prepares or prosecutes the application; and

(3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.

(d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.